

# **AN EXPLANATION FOR BETA'S MEAN REVERSION**

An Undergraduate Research Scholars Thesis

by

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## **ABSTRACT**

An Explanation for Beta's Mean Reversion. (May 2014)

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This study aims to improve upon the CAPM by showing that the beta risk value of a stock is mean reverting and this mean reverting tendency is caused by firms' growth. Ninety stocks categorized into three sets (small non-growth which start and end the period small, small growth which start the period small and end large, and large which start and end the period large) are examined over the time period 1992 to 2012. The mean reverting trend will be shown to occur in the small growth stocks while the small non-growth stocks' betas will be far removed from the market average of one and the large companies will be very close to one. Preliminary results have confirmed that small non-growth stocks have means' far from one and that large stocks have means that are very nearly one.

# **CHAPTER I**

## **INTRODUCTION**

The problem I wish to examine is to see whether or not the riskiness of a firm's stock as exhibited by the CAPM's beta value moves to the market average over time. Although it has already been shown that "there is a tendency for betas to converge rather slowly toward a norm (the stationary mean)" in James Ohlson and Barr Rosenberg's 1982 paper, Systematic Risk of the CRSP Equal-weighted Common Stock Index: A History Estimated by Stochastic-Parameter Regression, it does not attempt to explain why this effect occurs. This is where my research will extend the current body of knowledge on this subject. Furthermore, other papers on the subject look to describe this effect in foreign countries such as Faff et. al.'s 1992 paper, The form of time variation of systematic risk: some Australian evidence, or Syed Abuzar Moonis and Ajay Shah's 2003 paper, Testing for Time-variation in Beta in India. My research will help expand the knowledge of American stock's beta beyond what Ohlson and Rosenberg studied in 1982.

My primary objective is to prove that firms' stock risk, estimated by the CAPM beta value, will, over time, move towards the market average beta value. My secondary objective is to prove that because most firms tend to grow in size and that when they do this, their beta values fluctuate less, which is why we see beta mean reversion.

I will tackle this problem by gathering data from the WRDS database. This data will include but not be limited to daily stock price data for firms and a market index which will allow me to estimate beta. Beta will be estimated by comparing firm stock returns to the market index return

using a rolling equation with a window of time equally one quarter. The resources I will utilize are the WRDS database and the statistics program Stata.

## **Literature Review**

Moonis and Shah's paper studies the Bombay Stock Exchange by testing the NSE-50 index from 1996 to 2000. The authors test for time variation and mean-reversion in beta values. They find that 26 companies do not have a constant beta and that 14 of the non-constant betas are mean reverting. Their model is the modified Kalman filter that Harvey et al. (1992) developed.

De Bondt and Thaler's paper finds that many stocks' returns exhibit mean reverting qualities. More importantly for my research though, this paper finds hypothesizes that risk (beta) is time-varying. The authors think that because people see companies with lower returns as more risky than they actually are because they overreact to the low return and also because of many investors' "excess risk premium". On the other hand firms that have high returns have their risk valued correctly.

Ohlson and Rosenberg's paper explains how beta can best be estimated as a time-varying parameter. The authors found that when they estimated their model, beta was mean reverting and also that once per period, beta would have a shock that randomly changed its value.

Bos and Newbold's paper tests different ways of modeling stock returns and how their risk values are estimated. The authors conclude that beta is not a fixed value but is instead a time-varying parameter. Secondly, the authors found that although beta was not fixed, they could not reject the hypothesis that it was random nor the hypothesis that it was auto-regressive.

## Preliminary Data

Table 1

Variable	Obs	Mean	Std. Dev.	Min	Max
_b_sprtrn	7611	1.005219	.3370094	-.460144	2.428047

Table 2

Variable	Obs	Mean	Std. Dev.	Min	Max
_b_sprtrn	6711	.7480548	.3931395	-.5727974	2.86265

Table 1 and Table 2 show the beta value for Disney and Milipore Corp. respectively. It is clear that Disney's average beta of 1.005219 is much closer to one than Milipore Corp.'s average beta of .7480548. This paper tests thirty large companies like Disney, thirty small companies like Milipore Corp. and thirty growing companies. I test these companies to show that the beta value of a firm moves to one as it grows larger. Preliminary results indicate that this is the case for some companies but not others.

## **CHAPTER II**

### **PROBLEM**

#### **Data Source**

The data were collected through Wharton Research Data Services (WRDS). WRDS is run by The Wharton School at the University of Pennsylvania and provides business, financial, economic, and marketing data to over 290 institutions. Access to WRDS let me get the necessary data from COMPUSTAT. COMPUSTAT is a division of S&P Capital IQ and is a database of companies' financial information.

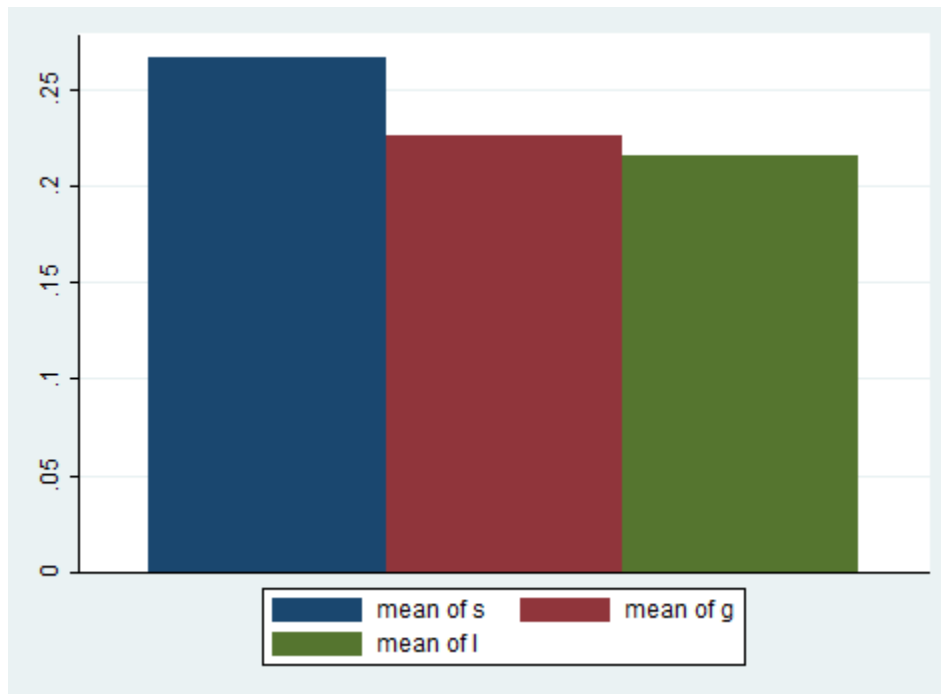
#### **Methodology**

Companies are divided into three categories: large, small, and growth. I run an ordinary least squares regression to come up with the beta values for each company. I then use a rolling window regression to plot these beta values over time. Once the beta values have been plotted over time, I find summary statistics such as mean and standard deviation and plot the time series graph to determine whether or not the beta value changed significantly over the period. I use Stata to run these regressions. Stata is data analysis and statistical software.

## CHAPTER III

### RESULTS

Figure 1



#### End Results

Smaller Firms are generally riskier than large firms. The average absolute difference of  $\beta$  from 1 is .266 (.200) and .215 (.121) for large firms. Growing firms' average absolute difference is .226 (.169). These results indicate that larger firms are less risky. Figure 1, shows these results graphically. Clearly, the average absolute difference of  $\beta$  from 1 for small companies (mean of s) is higher than both the average absolute difference of growing companies and large companies (mean of g and l respectively). Sadly, because the sample size is relatively small, standard



deviation is high so results are not statistically significant. In future research, increasing the sample size would correct this error.

### **Inferences**

From these results, it's clear that more research needs to be done in this vein. On average, firm growth reduces  $\beta$ . Additionally, firm growth reduces the variation in  $\beta$ . One of the benefits of the inconclusive nature of this research is that I, by proxy, reaffirm the capital asset pricing model. Because I cannot conclude that risk is effected by firm size, the capital asset pricing model is still the best way to describe the data.

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